External Information in Timeseries Forecast

# Why use external factors or covariates?

External factors or covariates can capture the effects of independent variables that are not part of your time series data, but may influence it in some way. For example, if you are modeling the sales of air-condition unit, you may want to include the temperature, season, and promotions as external factors or covariates, since they can affect the demand for ice cream. By including external factors or covariates, you can account for the variation in your time series that is not explained by its own history or structure, and reduce the error and uncertainty in your forecasts

# Choose between external factors or covariates

The choice of external factors or covariates depends on your research question, data availability, and domain knowledge. Select external factors or covariates that are relevant, measurable, and reliable for your time series problem. Avoid multicollinearity, which means that your external factors or covariates are highly correlated with each other or with your time series, as this can cause instability and bias in your estimates.

# Incorporate external factors or covariates

When incorporating external factors or covariates into your time series models, there are various methods you can use depending on the type and complexity of your data and model. One of the most common methods is regression with time series errors, which involves fitting a linear regression model with your time series as the dependent variable and your external factors or covariates as the independent variables. Additionally, you can maximize the ARIMAX method, which extends the ARIMA model by adding external factors or covariates as exogenous regressors. Another option is logistic regression.

# Example of external factors

Some very common examples of external or covariate elements which can affect the forecast are:

* Outliers
* Special events
* Interventions
* Correlated Time Series

We can add correlated time series to our time series data to improve forecast. As an example we can add the temperature data to improve forecast of outbreak of some agricultural diseases

As we know linear and logistic regressions can capture trend and seasonality as well as autocorrelation through autoregressive models. Another example which is explain in our textbook on page 157 is using lag 1 of gas price to forecast the airfare

Note in this case we cannot use the gas price at time *t* is incorrect since it is not available at the time *t*.